Nuclear Literacy: Is It Keeping Up with Nuclear Technology?

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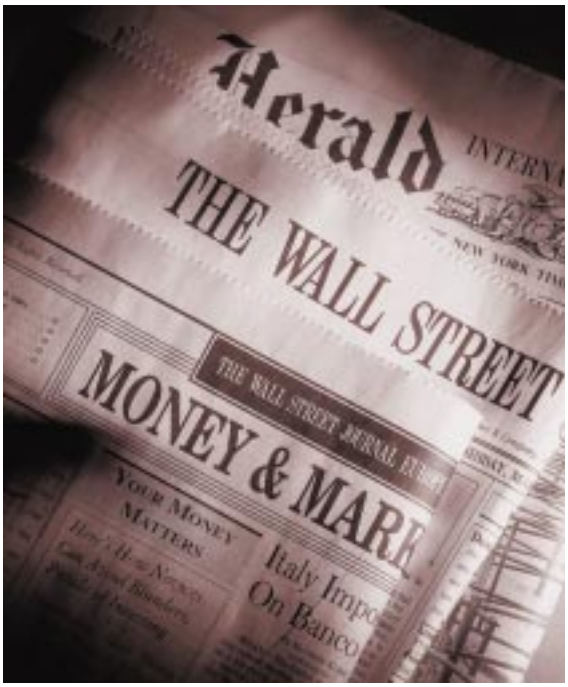
The recent nuclear accident in Japan illustrates a widespread nuclear illiteracy worldwide. The news media descriptions of this accident and the public's response compounded this illiteracy, further mystifying things nuclear rather than illuminating them. One is left with a sense of astonishment that this kind of accident can happen in a country that is widely known as technologically advanced.

As we learn more about the nature of this accident, a newspaper accounts allege that the plant operators fed "bucket full" loads of nuclear fuels into the processing vessels. As in ordinary fire, too much fuel at one time in an undesirable configuration can cause uncontrolled burns. The threshold for the uncontrolled nuclear burn or reaction is called criticality. The nuclear energy is released in the form of highly energetic radiation instead of heat energy as in ordinary fire.

A serious consequence of an uncontrolled nuclear reaction is that it is frequently accompanied by release of radioactive debris when the reaction is not completely contained. Radioactive debris is like ashes and smoke in a wood-burning stove. The difference is that these nuclear ashes themselves are highly radioactive so that they have to be contained and disposed of by suitable methods. In addition, the volume reduction resulting from fuel to spent fuel is not very big compared to that of a wood fire, and the hazard associated with handling nuclear waste is much greater from the human health point of view.

One important aspect of a nuclear reaction in terms of criticality is that it is totally predictable. We know how much material is safe to handle in what material types, shapes, and forms. The physical environment immediately adjacent to nuclear materials also affects nuclear reactions. The radiation from interactions with surrounding materials can cause another reaction indiscriminately. Nuclear reactors worldwide are operated under conditions finely tuned to maintain a sustained level of fuel burning while taking these effects into account.



The technology of harnessing nuclear energy has been around for a few decades, and it does not fall in the realm of some exotic nuclear reactions only nuclear physicists can comprehend. Since nuclear energy is vast compared to ordinary chemical energy, the harnessing of nuclear energy has played, and will undoubtedly play, a major role in meeting the world energy demand for generations to come. Presently, nuclear energy contributes to significant percentages of world energy consumption in many developed countries. It is therefore prudent that we be more in tune with its associated technologies and require training of its practitioners in all relevant fields. Members of the public, who benefit from the technologies, need to be better informed.

Information on peaceful applications of nuclear technologies should be shared among nations. Unknown to many, applications of nuclear technologies enhance many aspects of modern-day living. While it may never be possible for a majority of the public to learn

the technology base of everything in our daily lives, it is a paramount social responsibility that the practitioners of nuclear technologies should be well trained and knowledgeable in the technologies with which they are entrusted.

Here in the United States the number of students enrolled in nuclear engineering and other nuclear science fields has been declining for some time. During the last decade, the enrollment in nuclear programs in U.S. universities has declined at all levels by 50% with the undergraduate enrollments decreasing the most (Manpower Assessment Brief Number 44, May 1999, U.S. Department of Energy). During the same period the applications of nuclear technologies in energy production, medicine, agriculture, food safety, and numerous other areas have steadily increased. The basic reason for the drop in students' interest may be the perception of horrors connected with nuclear weapons and the association of those horrors with nuclear energy and all nuclear technologies.

If we closely examine some of the nuclear mishaps of recent years, their root causes can be traced to inadequate education and training of operators and/or the operator's negligence, especially the failure to follow procedures. It is now common for certain safety cultures to rely upon operational procedures developed by knowledgeable individuals other than the operators, thus, without the experience-based knowledge of the operators themselves. In the absence of that basic knowledge, any deviation from well documented procedures or use of ill-conceived procedures will invite a disaster to occur, particularly in the nuclear business. It is highly unlikely that the type of accident that happened in Japan would happen in the Unites States. Even so, neither the industry nor the government here seems to have a strategy to remedy the current general illiteracy problem confronting nuclear science and technologies.

Astronauts are educated in basic aerospace science and are trained to operate spacecraft. Imagine them consulting manuals and procedures on the way to the moon or experimenting with various rocket thrusts to see if they can get there faster or trying to take a shortcut! We are on this Earth ship together traveling through space. Now is the time for us to learn the science and technology that will allow us to use and consume our available resources properly and safely during our journey.

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